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Research Article

Antineoplastic and Cytotoxic Evaluation of Green AgNPs and Crude Extracts from *Agave americana*, *Mentha spicata*, and *Mangifera indica* Leaves

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Green silver nanoparticles (AgNPs) and crude ethanolic, methanolic, aqueous, and acetonic extracts from leaves of *Agave americana*, *Mentha spicata*, and *Mangifera indica* were scrutinized for possible antineoplastic and cytotoxic efficacy. In this study, all the synthesized AgNPs were characterized using UV-Vis spectroscopy, X-ray diffraction, SEM (scanning electron microscopy), TEM (transmission electron microscopy), EDX-spectroscopy, and simultaneous thermogravimetric and differential thermal analysis (TG-DTA). Results of various characterization analyses performed in this study revealed that synthesized AgNPs had the highest absorption at 410-430 nm, polycrystalline structure with sizes ranging from 23 to 38 nm, and were thermally stable up to 350°C. Furthermore, it was manifested that phytoproduced AgNPs from *A. americana* revealed good antineoplastic activity (69%). *M. indica*- and *M. spicata*-based AgNPs displayed moderate activity against PC-3 (prostate cancer cell line). Similarly, good cytotoxic aptitude was demonstrated by *A. americana*- and *M. indica*-based AgNPs at the highest sample concentration (1000 μL). Excellent cytotoxicity was revealed by ethanol (100%), methanol (100%), and aqueous extracts (100%) of A. americana and methanol extract (83%) of *M. spicata* at 1000 μL.

1. Introduction

Traditionally, medicinal plants have been used for the treatment of various human diseases and nowadays are being promoted as an alternative for health care systems. Furthermore, plant natural products are being used in food, pharmaceutics, and cosmetic industries owing to the beneficial properties associated with their respective biomolecules. Biomolecules like terpenoids and phenolics have been extracted, isolated, and characterized to increase awareness

regarding the mode of action underlying the bioactivities of plant extracts [1]. Nevertheless, a few limitations like poor bioavailability and solubility are associated with the use of plant metabolites [2]. Hence, researchers are focused on developing novel drug delivery systems to enhance the drug bioavailability and minimize toxic effects linked to the high dosage that is essential for optimal responses [3]. Purposely, metallic nanoparticles (NPs) are acquiring noteworthy consideration in the field of biomedicine and pharmaceuticals [4]. Nowadays, for the synthesis of green nanoparticles, various biological components like microbes, algae, enzymes, and plant extracts are being employed effectively. In recent times, the synthesis of nanoparticles via a green approach using plant extracts is being used as an innovative approach for the formulation of metallic nanoparticles due to their rapid, economical, eco-friendly, and safe nature [1, 4]. Various factors such as substrate concentration, fluctuation in pH and temperature, variable physiognomies of plant biomolecules, and type of metallic salt utilized may affect the morphological characteristics of nanoparticles. Therefore, synthesized green nanoparticles having specific morphological characteristics, stability, and size remain under development [5]. Plant extract-based green synthesized nanoparticles are considered a novel approach to treating different ailments such as cancer [6].

Cancers are globally recognized as a colossal family of afflictions that account for the atypical proliferation of living cells. It is commonly diagnosed due to the presence of a tumour (neoplasm) that often forms a mass or a lump which can be diffused metastatically [7]. Annually, mortality rates due to cancers are estimated at 13% worldwide in which breast, colorectal, lung, liver, and stomach cancers are predominant ones [8]. As cancer is a cluster of indisposition, therefore, its treatment by any solo therapy is impossible. Many anticancer treatments are currently under clinical in vivo and in vitro investigation to probe the fruitful remedy with minimal side effects [9]. Researchers are nowadays promoting the application of green silver nanoparticles (AgNPs) in multiple sectors of medicine due to their ease of production, purification, and least toxicity. The therapeutic effectiveness of these AgNPs has promoted their use as a promising nanotool in antineoplastic therapies. Earlier investigations on cancerous cell lines like MCF-7 (human breast cancer) and H-1299 (lung cancer) demonstrated the potentiality of biogenic AgNPs in the induction of cellular damage to tumours mainly by an inhibitory effect on NF-κB activity, reduction of bcl-2 expression, and elevation of caspase-3 and surviving expressions. Apoptosis is induced due to altered membrane integrity, followed by increased oxidative stress. The discussed mechanism of action might be helpful in the fabrication of potent nanodrugs [10, 11].

Extracts of experimented plants such as *Agave americana*, *Mentha spicata*, and *Mangifera indica* have been investigated earlier to validate their unique antineoplastic potentials. According to earlier studies, ethanol extract ($10\,\mu g\,mL^{-1}$) from *Agave americana* leaves exhibited eminent inhibitory activity against the human ovarian teratocarcinoma (PA-1) cell line [12]. Similarly, extract (methanol) from *Mentha spicata* leaves revealed significant antiproliferative activity against breast (MCF-7), colon (COLO-205), lung (NCI-H322), and hematopoietic (THP-1) cancer cell lines [13]. Methanolic leaf extracts ($200\,\mu g\,mL^{-1}$) from *Mangifera indica* have shown exceptional anticancer activity against bronchogenic (Chago K-1), ductal (BT-474), and gastric (Kato-III) carcinomas along with liver hepatoblastoma (Hep-G2) and colon adenocarcinoma (SW-620) [14]. Our research previously documented the synthesis, characterization, and biological evaluation of AgNPs using *Agave americana*, *Mentha spicata*, and *Mangifera indica* aqueous leaf extract which comprised of the method of green synthesis, characterization via spectroscopic instruments, and antibacterial, antifungal, antioxidant, hemagglutination, and phytotoxic investigations. In contrast, this study comprises green synthesis along with a purification method for the precise synthesis of AgNPs. The characterization via spectroscopy is more reformed and precise in this study. Finally, this article consists of antineoplastic and cytotoxic investigations of AgNPs against prostate cancer cell line (PC3) and normal cells (*Artemia salina*). Previously, we reported the antimicrobial and antioxidant activities of prepared nanoparticles using *Agave americana*, *Mentha spicata*, and *Mangifera indica* leaf extract [15]. Hence, this article is advanced and an extension of a previously documented study [15]. Nanotechnology is an important field that is based on the application and design of nanomaterials. Nanoparticles are normally in the range of 1-100 nm. The main interest in the field of nanoparticles is due to their different size, morphophonology area volume relation, and properties which are utilized in various fields including food, medical, and health [16–18]. Herewith, we designed the study to investigate the antineoplastic prospects and cellular toxicity of AgNPs and crude extracts (ethanol, methanol, aqueous, and acetone) from aerial parts (leaves) of *Mangifera indica*, *Agave americana*, and *Mentha spicata*.

2. Methodology

2.1. Plant Materials. Aerial parts (leaves) of *Agave americana*, *Mentha spicata*, and *Mangifera indica* were collected from various areas of District Peshawar, KPK (Pakistan), which was further discerned by a botanist Ghulam Jelani at Department of Botany, University of Peshawar.

2.2. Extraction. The collected leaves were cleaned, washed, and dried in the shade. After drying, leaves were subjected to the electric grinder to convert them into fine powder. Further, it was soaked in ethanol, methanol, and acetone for 2 weeks. For the preparation of aqueous leaf extract, powdered leaves (25 g) were boiled in distilled water (500 mL) for 30 min. Finally, all the filtrates were collected and concentrated through a rotary evaporator.

2.3. Phytosynthesis of Silver Nanoparticles (AgNPs). For the phytosynthesis of silver nanoparticles, prepared aqueous extract (10 mL) was mixed with a 1 mM solution of silver nitrate (90 mL). The resultant mixture was incubated for 60 min at 75°C in a shaking water bath (SWB-A, BIOBASE, China). Ag^{+} ions were converted to Ag^{o} nanoparticles, and

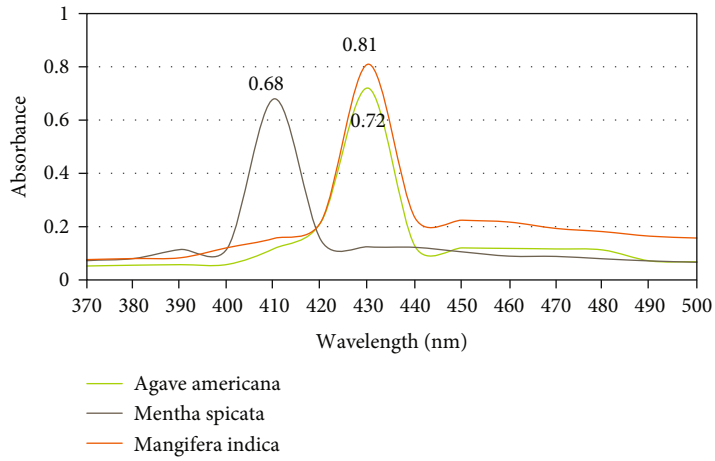


Figure 1: UV-Vis spectroscopic analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

this reduction was confirmed by the colour transformation of the solution from yellow to dark brownish-black. This solution was finally subjected to rotary evaporation (40°C) for the collection of concentrated AgNPs.

2.4. Purification of Silver Nanoparticles. Prepared AgNPs were purified from free biomolecules by adopting the methods described by Forough and Farhad [19]. Initially, prepared green AgNPs were mixed with water and subjected to centrifugation at 12,000*g* for 15 min (Merck, 5800 Centrifuge, USA). Resultant supernatants were separated and discarded, followed by a collection of purified AgNP pellets. The purified AgNPs were dried by spreading them onto sterilized Petri plates and kept at room temperature (≤50°C) until desired dried product is achieved.

2.5. Characterization of Silver Nanoparticles

2.5.1. UV-VIS Spectroscopy. Greenly synthesized nanoparticles were probed for their optical properties concerning λ_{max}. The proposed UV-Vis spectrophotometer (Shimadzu UV-1601) was utilized by adjusting the resolution of 10 nm in a standard range of 350 nm and 500 nm [20].

2.5.2. X-Ray Diffraction Measurements (XRD). The crystallinity of the fabricated AgNP pellets was evaluated by using an X-ray diffractometer (JDX-3532) with radiation of 1.54187 nm wavelength and a power setting of 30 kV/30 mA [21]. The diffractogram was then analyzed using software Origin 6.1, to calculate the average crystalline size by following Beer-Lambert Law, i.e., $A = \varepsilon bc$, where "A" is the absorbance, "ε" is the molar absorptivity of the nanostructures, "b" is the path length of light, and "c" is the concentration of the sample.

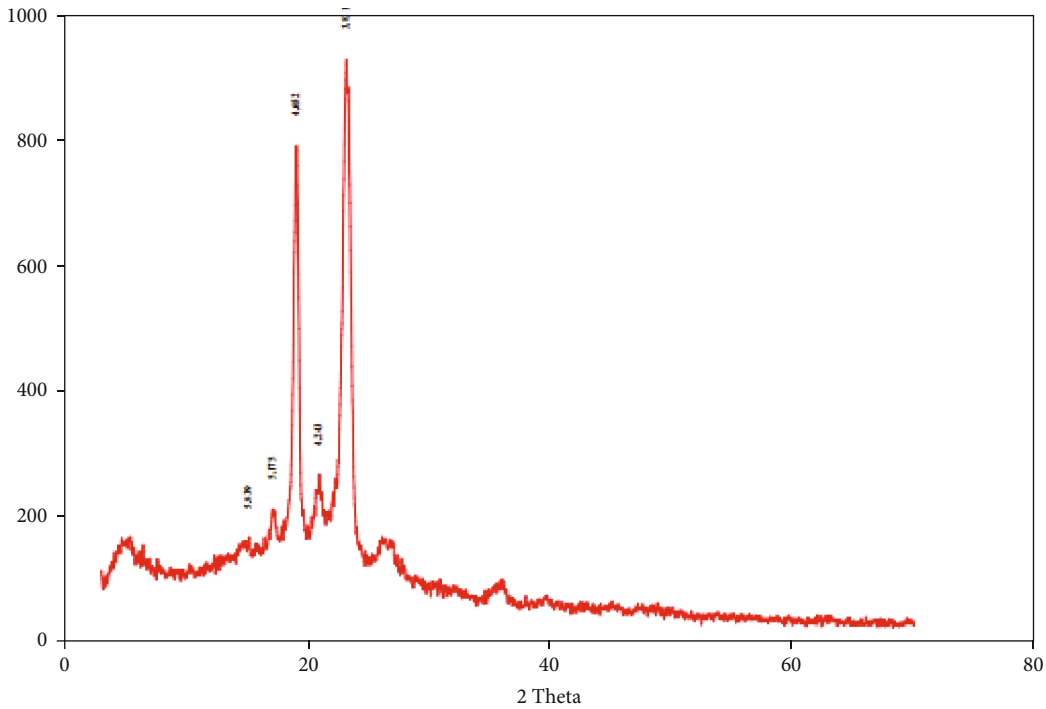
2.5.3. Scanning Electron Microscopy (SEM). The green AgNPs were also morphologically scanned using SEM (JEOL-JSM-5910) model. Carbon-coated copper grids were loaded with thin films of test AgNPs, which were further dried by subjecting them in a mercuric vapor lamp for five minutes. Finally, the grids with loaded test AgNPs were microscopically investigated at 150x, 500x, and 1000x magnification [22].

2.5.4. Transmission Electron Microscopy (TEM). The size of green AgNPs was analyzed via TEM (Techni-G2-300 kV). Similar to SEM, a thin film of test AgNP solution was prepared on the carbon-coated copper grid, which was then vaporized using a mercuric vapor lamp for 5 minutes. Finally, a 2D micrograph of test AgNPs manifesting the size was observed [23].

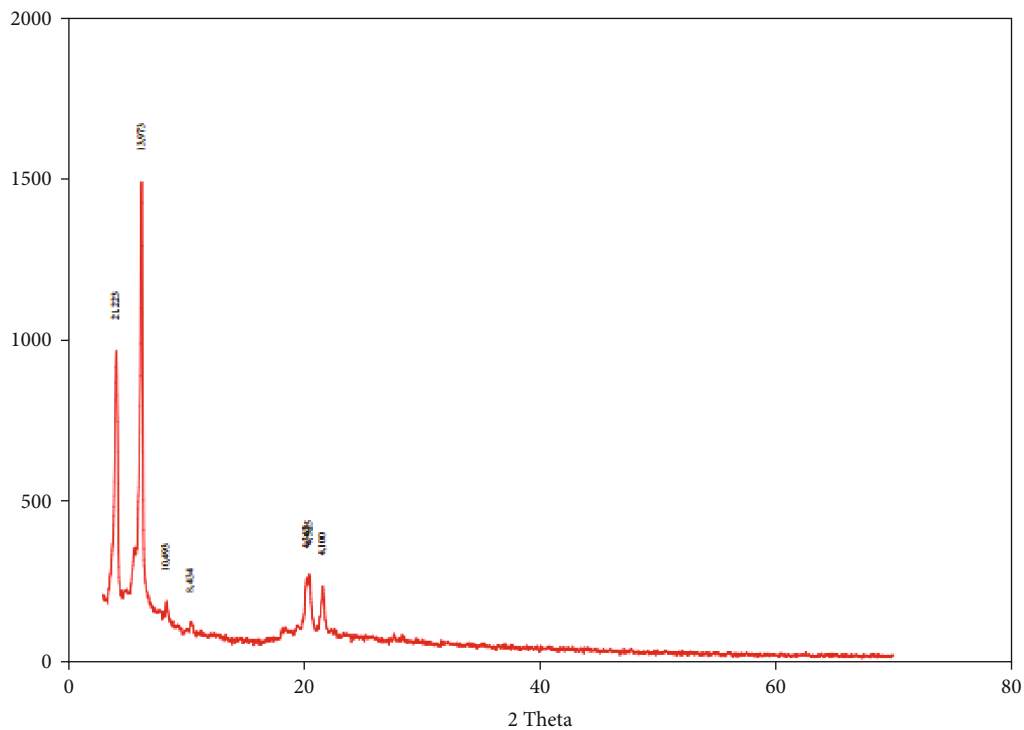
2.5.5. Energy-Dispersive X-Ray Spectroscopy (EDX). For the elemental analysis of prepared AgNPs, energy-dispersive X-ray spectroscopy (INCA-200) model was employed. The generated observations will affirm that AgNPs are precisely bioreduced by phytochemicals present in utilized aqueous leaf extracts.

2.5.6. Simultaneous Thermogravimetric and Differential Thermal Analysis (TG-DTA). The physical and chemical stability to variable high temperatures of the fabricated AgNPs was analyzed by the simultaneous thermo-gravimetric and differential thermal analysis (Shimadzu DTG-60/DTG-60A) model. Gain and loss of mass of AgNPs were recorded in the range of 0 to 900°C [24].

2.5.7. MTT Cell Proliferation Bioassay. For analyzing the antineoplastic activity of fabricated phyto-AgNPs and crude extracts of plants, MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide) cell proliferation procedure was carried out according to Mosmann [25]. Prostate cancer cell line (PC-3) was cultured in sterilized Petri plates using the requisite medium along with supplementation of fetal bovine serum (15%) and penicillin (1%) (Invitrogen). It was then incubated at 37°C for 24 h in the presence of CO_2 (5%). Trypsin/EDTA solution (0.25%) was used for the proliferation of tumour cells. PC-3 cell line (prostate cancer) was cultured on a sterilized 96-well microtiter plate. Methanol (50%) was used for the preparation of a stock solution (10 mg mL^{-1}) followed by the preparation of a working solution (1 mg mL^{-1}) using diluting the stock solution with culture broth. The cultured PC-3 cells (1×10^4 cells/well)

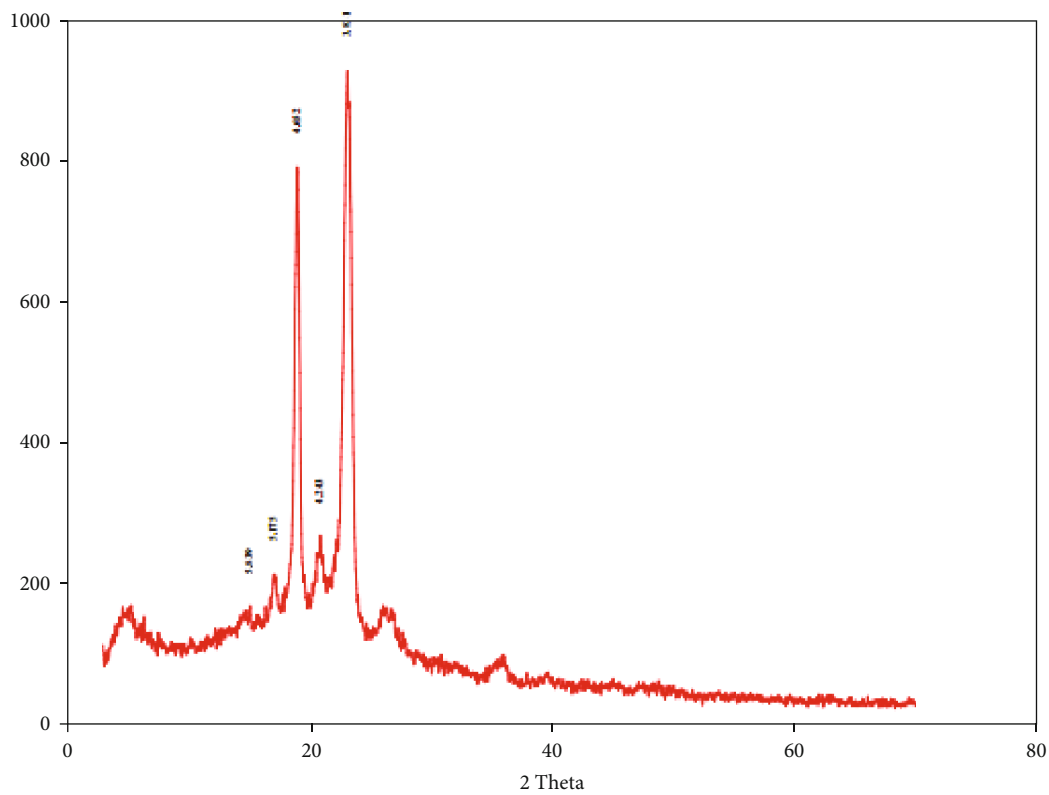


(a) A. americana



(b) M. spicata

Figure 2: Continued.



(c) M. indica

Figure 2: (a–c) XRD analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

subjected to microtiter plates were treated with a prepared working solution for 24 h. After incubation, MTT reagent (10 μL) was added to each reacting microtiter well and left for 3 h in the incubator. The culture medium having MTT reagent was washed, and DMSO (200 μL) was added to it before reincubation (20 min). A synergy microplate reader was used for analyzing the optical absorbance at 550 nm. In this experiment, doxorubicin, a standard chemotherapy drug, acted was used as a positive control [26]. Percent anticancer was calculated using the optical density formula:

$$\text{Percent anticancer activity} = 100 - \frac{\text{OD of test well}}{\text{OD of control well}} \times 10. \quad (1)$$

2.5.8. Cytotoxic Bioassay. In this assay, the brine shrimp (*Artemia salina*) lethality procedure was adopted to analyze the cell toxicity of biosynthesized AgNPs and crude extracts [27]. A saline environment was provided to brine shrimp eggs to facilitate the hatching process. Eggs weighing 50 mg were placed in a dark chamber of apparatus, where they were hatched at room temperature (48 h). A Pasteur pipette was used to collect nauplii from the apparatus. Stock solution (10 mg mL^{-1}) was prepared from methanol, followed by dilutions (10, 100, and 1000 μL) to sterilized flasks. Methanol was evaporated at room temperature by placing the flasks in the laminar flow hood for 30 min. Flasks were added with brine (1 mL) solution, and a Pasteur pipette was used to place shrimp larvae (10) on the flasks. The final volume was adjusted to 5 mL using brine solution followed by incubation at 28°C for 24 h. For this assay, etoposide, a standard chemotherapy drug, was used as a positive control, and methanol acted as a negative control. Cytotoxicity against brine shrimps was calculated by observing the number of dead larvae via a magnifying glass. Percent lethality was calculated using the formula:

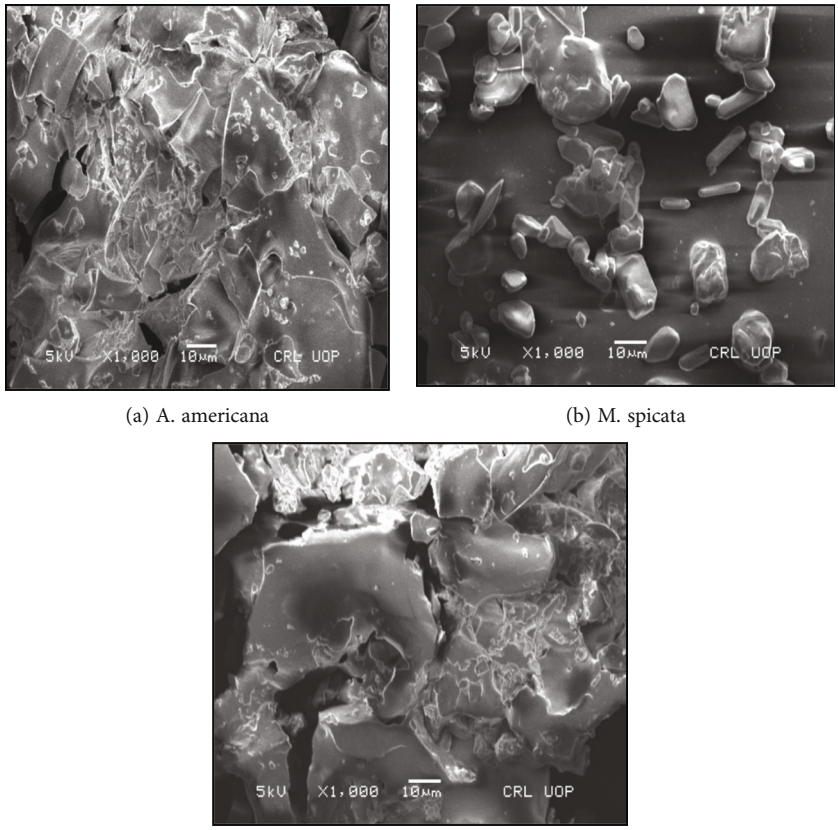
$$\text{Percent cytotoxicity} = \frac{\text{No.of dead}}{\text{Total no.of shrimps}} \times 100. \quad (2)$$

2.5.9. Statistical Analysis. In this study, a comparison among different groups was done using an unpaired t-test. A $p < 0.05$ was considered to be significant [28, 29].

3. Results and Discussions

3.1. Characterization of Silver Nanoparticles

3.1.1. UV-VIS Spectroscopy. From the UV-Vis analysis, it was observed that the highest λ_{max} for the test AgNPs from *A. americana* and *M. indica* was observed at 430 nm while the λ_{max} for the test AgNPs from *M. spicata* was observed at 410 nm. The results are depicted in Figure 1, which alludes to the precise composition of bioreduced AgNPs. The variability in sample absorbance is due to the presence of



(a) A. americana (b) M. spicata

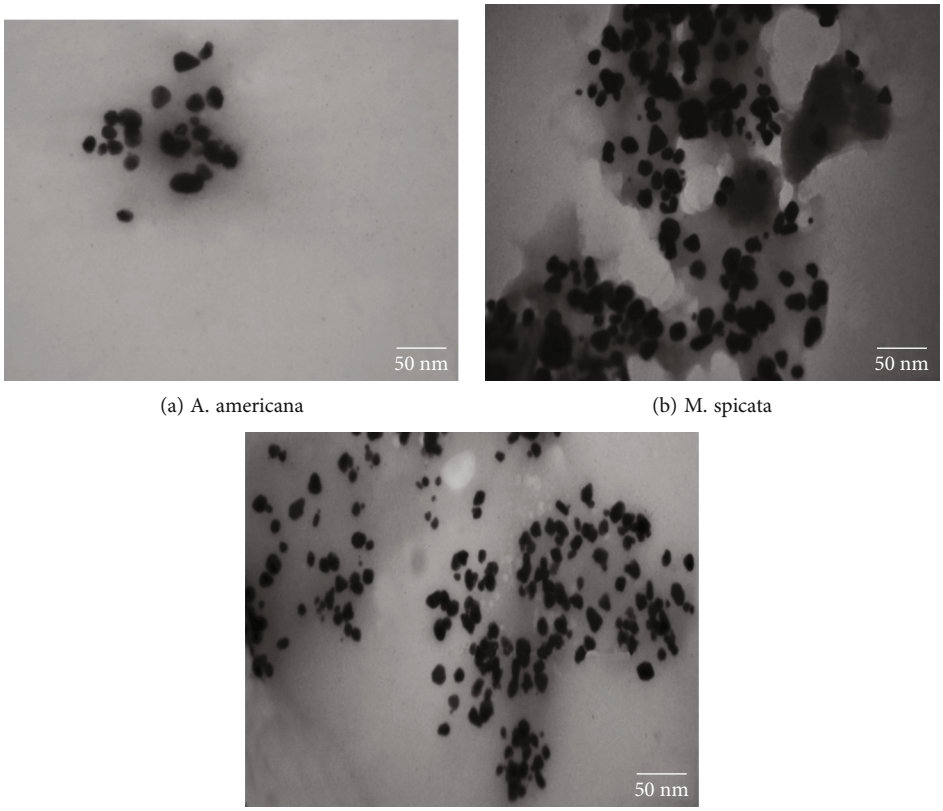
(c) M. indica

Figure 3: (a–c) SEM analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

phytoingredients that are present in leaf extracts which actively reduce Ag^{+1} to Ag^{o}. The profuse presence of polyphenols provides a λ_{max} peak at higher intensities. The peak absorbance at a higher intensity may also account for increased particle shape and size due to the excitation of particle surface plasmon resonance. Ahmad et al. reviewed various spectroscopic aspects of greenly fabricated AgNPs. From the documented data, it was analyzed that the highest peak absorbance, i.e., λ_{max} for green AgNPs, lies in the range of 350-500 nm. The λ_{max} peak observed between 400 and 450 intensity corresponds to the presence of active polyphenols in plant extracts and excitation of reduced silver upon absorbance of UV-Vis rays [30].

3.1.2. X-Ray Diffraction Measurements (XRD). From XRD analysis, the observed 2θ values in the range of 10°–80° for the green test AgNPs showed intense peaks at variable intensities. All three greenly synthesized AgNPs were observed to possess polycrystalline structures. According to Beer-Lambert Law X-ray, the estimated size of each fabricated AgNPs may be 32 nm for *A. americana*, 38 nm for *M. indica*, and 23 nm for *M. spicata*, respectively. The results are summarized in Figures 2(a)–2(c).

3.1.3. Scanning Electron Microscopy (SEM). From the morphological analysis of green test AgNPs, it was manifested that all of the three test samples have affirmed polycrystalline nature having variable morphologies, i.e., mostly spherical but few triangular, rods, and cubic were also observed. The results are shown in Figures 3(a)–3(c). The variations in the morphologies occur due to multifarious factors peculiarly storage time, pH, temperature, and type of plant or plant part utilized. In the current study, the variability may occur due to the leaves utilized, which possess different quantities and quality of phytochemicals which trigger the variation to produce stable AgNPs. The other factors that account for variation are that storage time and exposure to environmental conditions such as light and temperature may shrink or maximize the size of AgNPs, thus changing their morphologies. The precise nature of shape disparity is still unclear, but it can be manifested that nanoparticles can transform their shape easily at various reaction conditions. The energy used for synthesis may define the shape and nature of nanoparticles. The size of nanoparticles may increase when it is stored for extended periods, because phytocompounds present in plant extracts may coat the structure up to multiple layers to provide stable conformation. It is also reported that reaction environments such as alteration from wet to dry conditions and the presence of stabilizing agents such as peroxides and hydroxides greatly influence the size of nanoparticles, thus altering their physicochemical and functional properties.



(a) A. americana (b) M. spicata

(c) M. indica

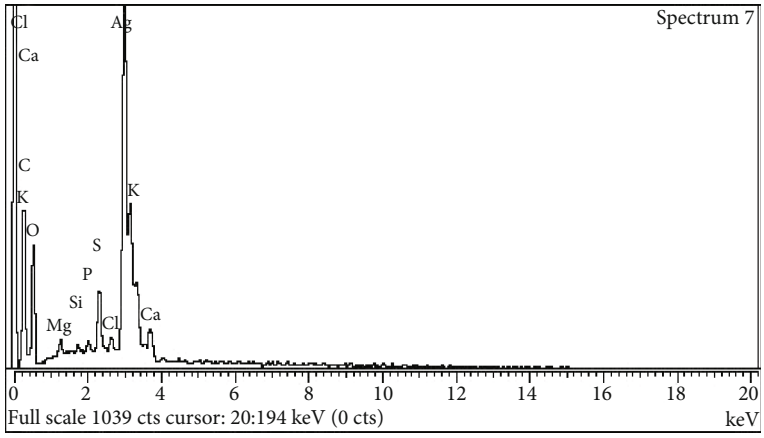
Figure 4: (a–c) TEM analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

3.1.4. Transmission Electron Microscopy (TEM). From TEM analysis, it was manifested that the size of most of the green AgNPs lies in the range of 30-100 nm. Environment Protection Agency (US) and World Health Organization (WHO) classify the particles as ultrafine AgNPs because it mostly lies in a size range ≤ 100 nm. Results are shown in Figures 4(a)–4(c). The size range is desirable to their pharmacological value, i.e., ≥20 nm, because it can easily penetrate the biological barriers to reach the target sites for therapeutic purposes. Although the size of fabricated nanoparticles is small enough to evade the biological barriers but large enough, i.e., ≥20 nm, to evade the meningeal barrier of the brain, hence, it provides a safer therapeutic option to treat many ailments [31]. These AgNPs are plied in the least doses to remediate the affliction, as these desirable nanostructures have a higher surface area and can reach the targeted site more precisely than larger sizes. The least therapeutic dose not reduce the chances of side effects but also aids to manufacture cost-effective drugs having proficient outcomes.

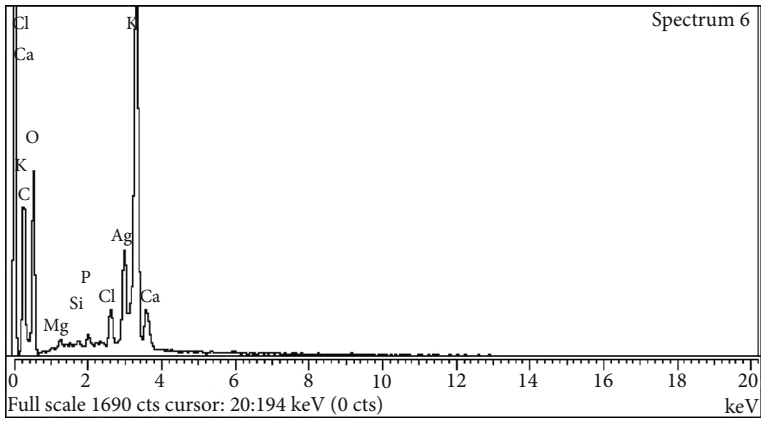
3.1.5. Energy-Dispersive X-Ray Spectroscopy (EDX). From EDX analysis, it was manifested that AgNPs from *A. americana*, *M. spicata*, and *M. indica* possess metallic silver in the bioreduced form in the amount of 34.91%, 9.96%, and 9.93%, respectively. Some other organic elements were also observed such as carbon, oxygen, chlorine, calcium, magnesium, silicon, sulphur, and potassium. Results are shown in Figures 5(a)–5(c). The percentage of bioreduced silver is more than that of organic elements because the phytochemicals present in the plant extracts actively reduce the silver ion, and by itself, it gets oxidized. Some of the phytochemicals/organic elements are utilized by these AgNPs as stabilizing and capping agents to coat the surface of the AgNPs, which are displayed graphically. Some of the uncharged and surplus organic compounds are omitted in the purification step of AgNP fabrication.

3.1.6. Simultaneous Thermogravimetric and Differential Thermal Analysis (TG-DTA). From the TG-DTA analysis, it was manifested that green AgNPs from *A. americana*, *M. spicata*, and *M. indica* were thermally stable up to 350°C, while the mass loss was recorded between 350 and 800°C. Hence, this suggests that green AgNPs can function in high temperatures because of their thermally stable conformation. The results are shown in Figures 6(a)–6(c).

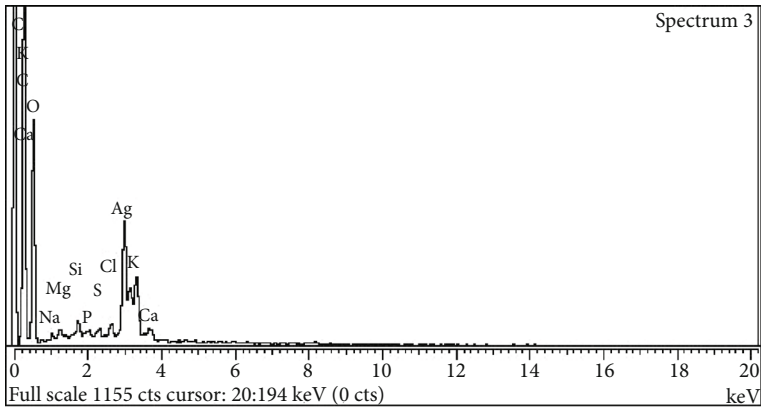
3.1.7. MTT Cell Proliferation Bioassay. It is evident from the results of the MTT cell proliferation bioassay against a PC-3 cell line that phytosynthesized AgNPs and acetone extract (A.E.) from leaves of *Agave americana* exhibited satisfactory 69% antineoplastic capacity (IC_{50}: 14.02 $\mu g\,mL^{-1}$) and 78% (IC_{50}: 10.96 $\mu g\,mL^{1}$), respectively. A crude fraction from *A. americana* was inactive against the tested tumour cell line. Moderate antiproliferative activity was demonstrated by



(a) A. americana



(b) M. spicata

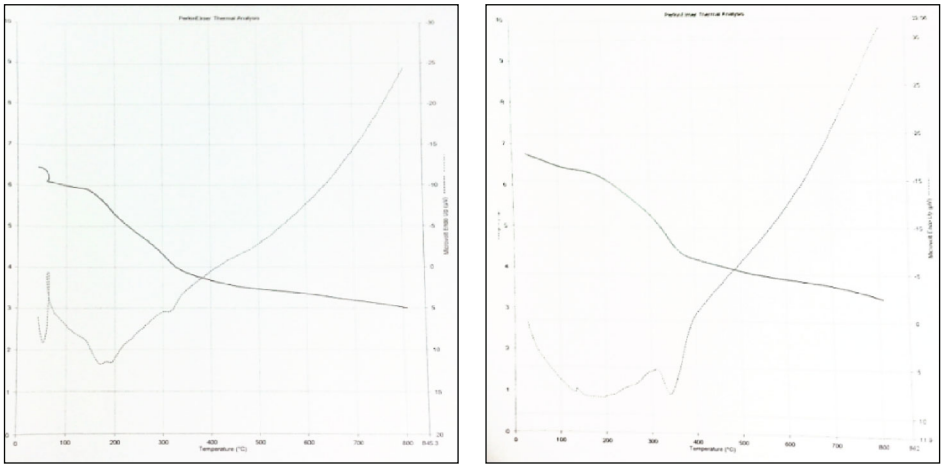


(c) M. indica

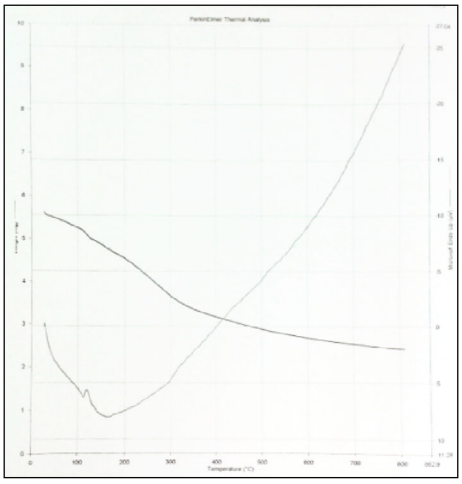
Figure 5: (a–c) EDX analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

acetonic extract (A.E.), ethanol extract (E.E.), and AgNPs from *M. spicata* leaves accounting for 55, 48, and 42%, respectively, owing to computed median lethal dose (IC_{50}) values of 225.14, 201.54, and 188.09 μg/mL. On the other hand, average anticancer competence (44%) was exhibited by green AgNPs prepared from *M. indica* leaves. The rest of the crude extracts from M. indica leaves remained inactive against the PC-3 cell line as they manifested a lower inhibitory percentile as compared to AgNPs. Anticancer effects of AgNPs, ethanol extract (E.E.), methanol extract (M.E.), aqueous extract (Aq.E), and acetone extracts (A.E.) from leaves of *Agave americana*, *M. indica*, and *M. spicata*, respectively, are presented in Figures 7–9.

Preliminary in vitro studies on the antineoplastic capacity of biogenic AgNPs document that monodispersed particles (10.09 nm) displayed high therapeutic properties against various cancer cell lines (breast and lung cancer) owing LD_{50} value of 100 μg/mL [32, 33]. Accordingly,



(a) A. americana (b) M. spicata



(c) M. indica

Figure 6: (a–c) TG-DTA analysis of green AgNPs from *A. americana*, *M. spicata*, and *M. indica*.

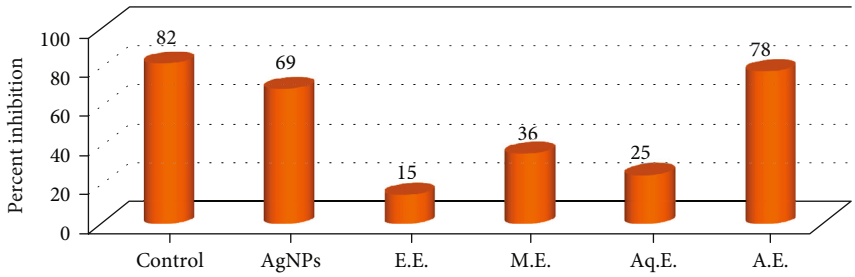


Figure 7: Anticancer effect of AgNPs and crude extracts from *Agave americana* leaves.

phytoingredients such as phenolic and flavonoids present in various parts of M. spicata and *M. indica* plants exhibited unique anticancer activity against experimented prostate (PC-3), lung (A-549), and breast (MCF-7) cancer cell lines owing LD_{50} values in the range of 0.010-0.030 [34, 35]. Similarly, in a study conducted earlier by Bardaweel et al. [36], it was exhibited that the essential oil from the aerial parts of *M. spicata* had meaningful anticancer activity against the three examined human cancer cell lines, i.e., T47D (324 $\mu g\,mL^{-1}$), HCT-116 (279 $\mu g\,mL^{-1}$), and MCF-7 (975 $\mu g\,mL^{-1}$).

3.1.8. Cytotoxic Bioassay. Results regarding a cytotoxic assay for AgNPs, ethanol extract (E.E.), methanol extract (M.E.), aqueous extract (Aq.E.), and acetone extract (A.E.) from

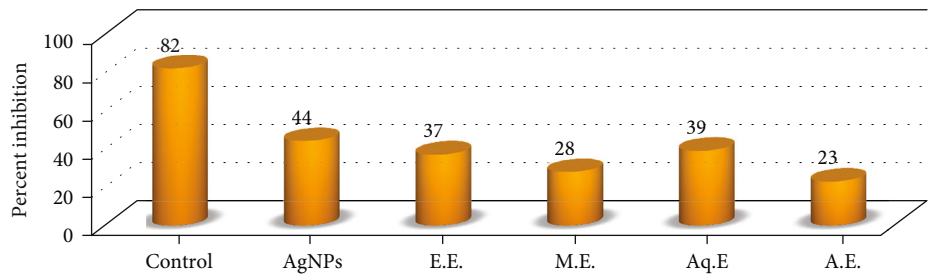


Figure 8: Anticancer effect of AgNPs and crude extracts from *Mangifera indica* leaves.

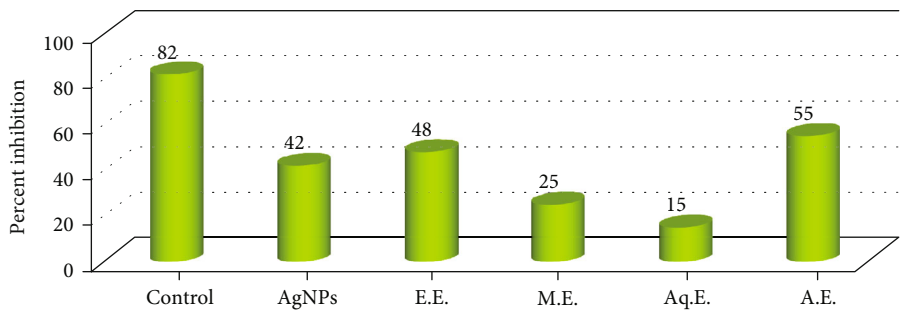


Figure 9: Anticancer effect of AgNPs and crude extracts from *Mentha spicata* leaves.

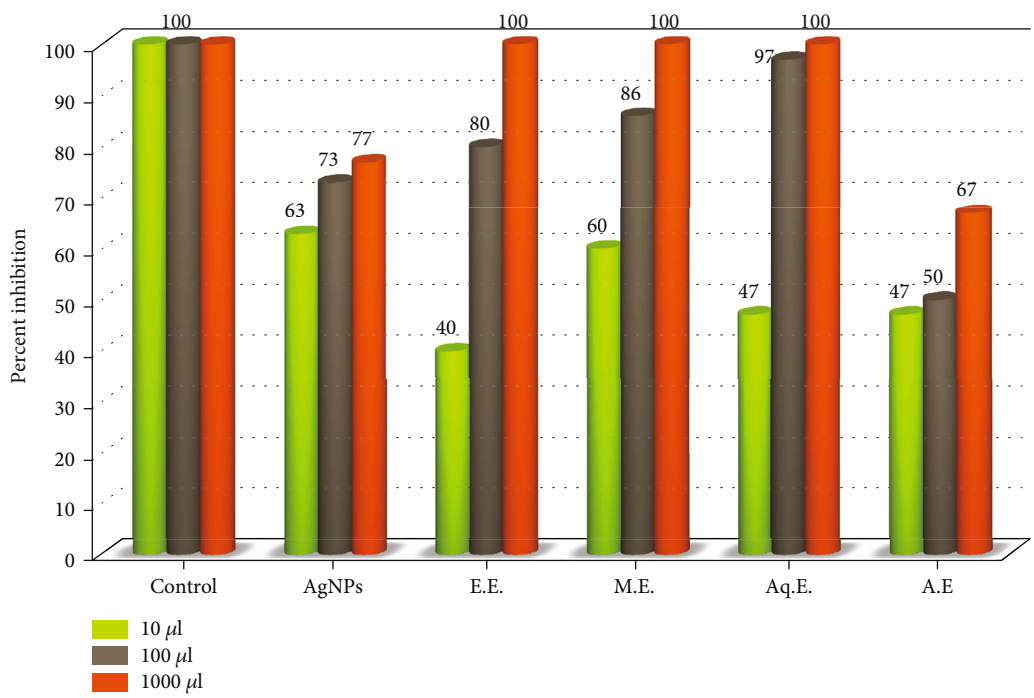


Figure 10: Cytotoxic assay for AgNPs and crude extracts from *Agave americana* leaves.

leaves of *Agave americana*, *M. indica*, and *M. spicata*, respectively, are presented in Figures 10–12.

From Figure 10, it could also be inferred that the crude extracts possessed significant cytotoxicity at 100 μL, while moderate cytotoxicity was noted at 10 μL concentration. Among the varied experimented concentrations (10, 100, and 1000 μL) of E.E., M.E., and Aq.E. from *A. americana* leaves manifested significant cytotoxic capacity, i.e., 100% at 1000 μL, against *Artemia salina*. Their LD_{50} values were noticed as 17.20, 5.76, and 10.52 $\mu g\,mL^{-1}$, respectively. In contrast to this, green synthesized AgNPs from *A. americana* proved good activity (LD_{50}: 0.312 $\mu g\,mL^{-1}$) at varying

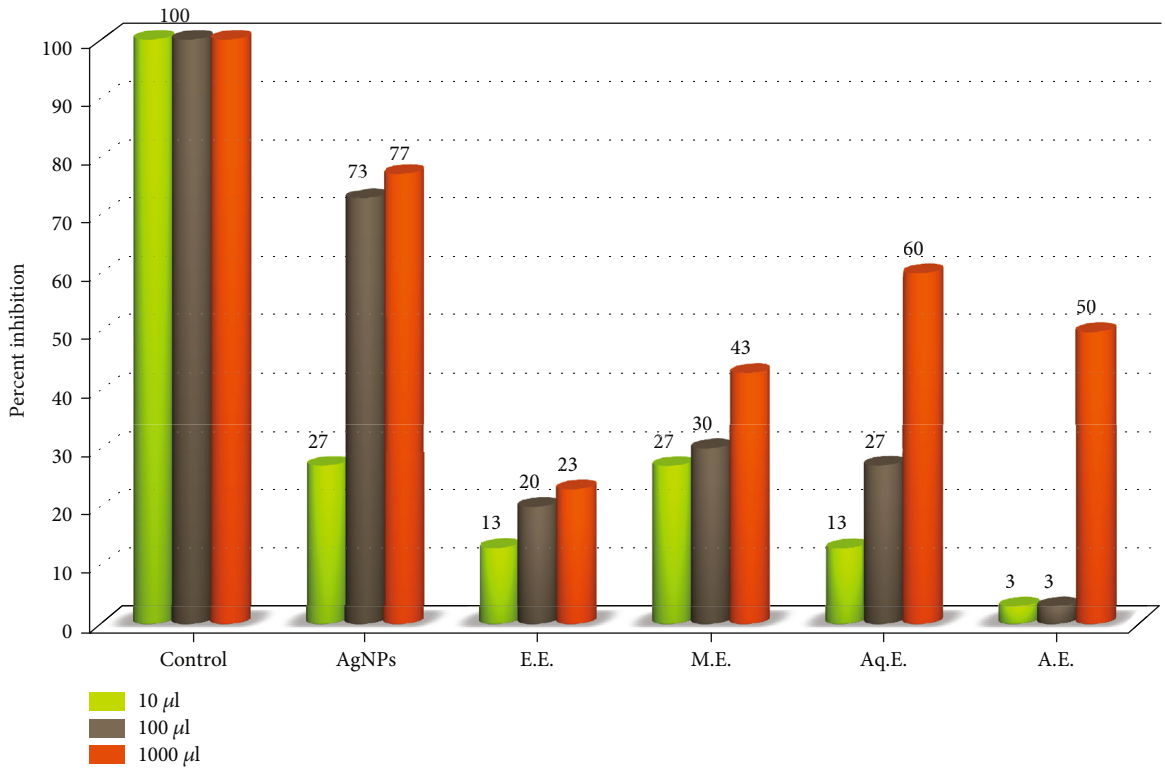


Figure 11: Cytotoxic assay for AgNPs and crude extracts from *Mangifera indica* leaves.

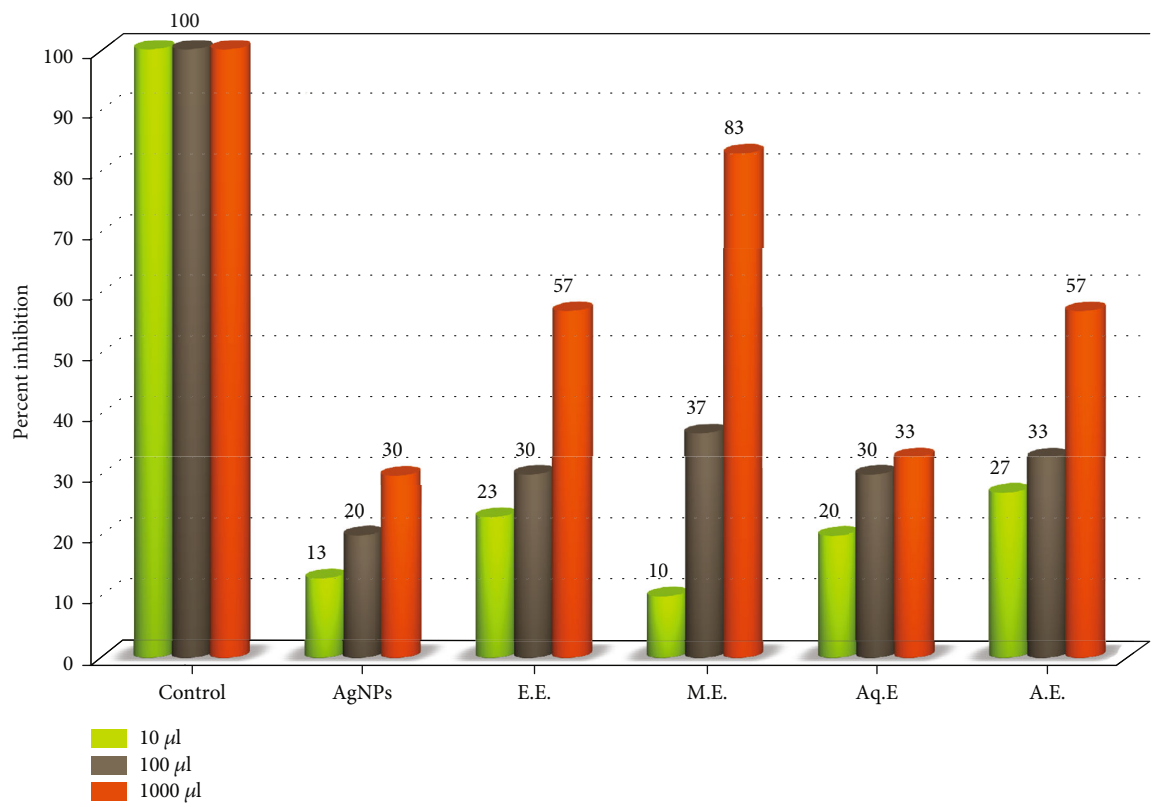


Figure 12: Cytotoxic assay for AgNPs and crude extracts from *Mentha spicata* leaves.

concentrations. At 1000 μL and 100 μL concentrations, AgNPs and all the experimented crude extracts from leaves of *M. indica* exhibited good to moderate cytotoxic potentials having LD_{50} values of 42.76 μg mL^{-1} and 225.63 μg mL^{-1}. M. indica ethanol extract manifested low cytotoxic potential at all concentrations. Similarly, AgNPs and aqueous extract of *M. spicata* leaves demonstrated less cytotoxic capacity while significant activity (LD_{50}: 161.85 μg mL^{-1}) was demonstrated by methanol extract at 1000 μL concentration. Earlier in vitro cytotoxic investigations have revealed that biofabricated AgNPs own tremendous cytotoxic effects on organism cysts mainly due to abrupt genetic modifications, induction of apoptosis, viscera aggregation, and suspension of nauplii hatching. Induction of acute cell toxicity (LD_{50}: 2.40 and 8.9 mg mL^{-1}) at maximum concentrations has been reported from bark extracts of *M. indica* and *M. spicata* [15, 37]. *A* cytotoxic investigation conducted by Navarro et al. [38] documented the effect of methanol extracts from M. *indica* (flesh and skin) on various cancerous cell lines like AGS (gastric adenocarcinoma), HepG2 (hepatocarcinoma), and SW620 (colon adenocarcinoma). Besides, *M. indica* skin methanol extract revealed IC_{50} value to be in the range of 138-175 g mL^{-1}.

4. Conclusion

The present study concluded that AgNPs fabricated using aqueous leaf extracts of *Agave americana*, *Mangifera indica*, and *Mentha spicata* manifest maximum UV-Vis absorbance in the range of 400–450 nm, showing that the plant extract utilized has effective bioreducing and biocapping capacity to produce green AgNPs in an economic and eco-friendly manner due to profuse presence of phenolic compounds. These AgNPs were characterized as mostly spherical, stable, polycrystalline having a size range of 30–100 nm in diameter, which is considered ultrafine particles by WHO and EPA. The desirable size range of AgNPs showed moderate to useful antineoplastic potencies at various concentrations. Among all AgNPs, A. americana-based nanoparticles possess good antineoplastic potential, i.e., 69%. An increase in sample concentration can bestow preeminent antiproliferative activity, which can be utilized in advanced chemotherapies for tumour management. In contemplation of anticancer aptitude, cell toxicity was observed at relatively higher concentrations that aided to restrain the growth of the PC-3 cancer cell line. Explicitly, good cytotoxic aptitude was observed in the case of *A. americana*- and *M. indica*-based AgNPs at the highest sample concentration (1000 μL). Excellent cytotoxicity was revealed by ethanol (100%), methanol (100%), and aqueous extracts (100%) of *A. americana* and methanol extract (83%) of M. spicata at 1000 μL. Hence, validating the use of these compounds is less risky and secure for therapeutic purposes.

Data Availability

The data used to support the findings of this study are available from the corresponding authors upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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